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ABSTRACT

Presenting a model for the comparative analysis of farm organizations, this paper analyzes the farm firm as a complex organization; identifies key structural dimensions of an agricultural production unit; and reviews various organizational perspectives for their utility in understanding and explaining the behavior of farm operations and farm operators. Four lines of comparative inquiry which are used to understand patterns of efficiency and effectiveness and to define those factors contributing to growth and decline in the population of farm production units are examined: (1) population characteristics, (2) organizational unit characteristics, (3) farm manager characteristics, and (4) environmental characteristics. Population studies of the farm industry seek to link ecological characteristics to changes in the number and distribution of farm firms. Studies of farm organizational units examine the size, scale, and internal structure of farm organizations to determine their behavioral characteristics and responses to environmental conditions. Attention is paid to outcome measures of effectiveness and efficiency. Managerial characteristics represent a set of conditions suggested by open systems theory: openness to innovation, educational levels, and motivations of farm operators are fundamental forces determining organizational responses to environmental conditions and technological change. Additionally, the external technology of the organizational environment represents a central set of factors determining the range of solutions available for organizational and productivity problems. (CM)

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A FRAMEWORK FOR THE COMPARATIVE ANALYSIS OF FARM ORGANIZATIONS*

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A Framework for the Comparative Analysis of Farm Organizations

Farms are formal organizations; they have as an explicit purpose the achievement of certain goals (Haas and Drabek, 1973:1). All farms generally share the objective of producing some crop or commodity for eventual sale and distribution. As such, farms are profit-seeking or economic entities.[1] However, many farm units are intertwined with the operation of family units that provide a set of influences that differentiate the farm from the classical notion of the economic firm. Farms are also unique as complex organizations due to intimate dependence on the physical environment and the significant effect that relationship has on the growth or decline of the farm operation. Thus, farms are a distinctive type of complex organization bearing certain characteristics that set them apart from traditional sociological conceptions of organization or economic theories of the firm.

Much literature is devoted to the analysis of the farm as an economic entity. Agricultural economists pay particular attention to farm management strategies governing the choice and mix of farm enterprises and the effect of supply and market conditions on decision-making. Economic approaches tend to be dominated by the profit-maximization criterion that gives purpose and direction to analysis.

A traditional role of sociologists in farm-oriented research has been in the analysis of adoption and diffusion of innovations that improve productivity, adaptability, and implicitly, profitability (Rogers and Shoemaker, 1973). Some sociologists have examined farm family relationships, particularly the role of different family members in decision-making (Wilkening, 1954; Hobbs et al., 1964; Coughenhour and Kowalski, 1977). Few researchers have attempted to examine the farm as a complex organization to identify

1

key structural dimensions, or to apply a developing literature on the mediating role of technology on organizational structure in agricultural production units. Little attention has been given to structural characteristics of farm organization and their consequences for farm growth and development.

The purpose of this paper is to develop a model or framework for the comparative analysis of farm organizations. By reviewing selected approaches to the comparative analysis of complex organizations, we identify a loosely interrelated cluster of variables that may be used as a model to guide future research. The paper analyzes the farm firm as a complex organization and identifies key structural dimensions of an agricultural production unit. Various organizational perspectives are reviewed for their utility in understanding and explaining the behavior of farm operations and farm operators. The concept of organizational environment is developed as a central set of influences on farm activity. Finally, technology is treated as an intervening set of factors affecting organization-environment interaction.

Levels of Organizational Analysis

Organizational analysis may be approached at a number of different levels, each with a characteristic set of research questions and research strategies. Five levels can be identified: (1) members, (2) subunits, (3) individual organizations, (4) populations of organizations, and (5) communities of (populations of) farm organizations.[2]

Members of a farm organization might logically include the owner, the farm manager, farm employees, and tenants. Traditionally, family members actively participated in farm operation, and organizational life had considerable overlap with family life. An important trend in modern agriculture is the increasing segregation of family life from farm life, particularly in large scale farming.

Farm subunits usually are identified as enterprises in agricultural economic approaches. Crops, cattle, and dairy enterprises are considered as separate entities within the farm unit for management and accounting purposes. Except in corporate or very large family farms, the enterprise structure usually is not reflected in a division of labor among farm personnel. Roles often are differentiated in general ways, but the cyclic demand of crop and animal reproductive cycles tend to resist specialization and compartmentalization of individual responsibilities.

Comparative analysis refers to research that goes beyond member or subunit level and focuses on sets of organizations or sets of populations of organizations. Comparative analysis requires the systematic collection of information on relevant organizational variables across a number of organizations (Scott, 1975:3).

Sample survey approaches to farm organizations operate on a comparative level (Hoiberg, 1978; Houseman, 1979). Data are obtained from the farm operation (and often other participants) about the size, composition, and structural arrangements of the farm. Descriptive results often focus on the number and types of units in a given area or engaged in a given enterprise. Sociological analysis often focuses on determining the structural features and operator characteristics associated with some measure of success, the use or non-use of some practice or technology, as well as preferences for operating style or management arrangement. Agricultural economists frequently employ comparative data, applying linear programming methods to derive budgets and optimal enterprise mixes based on reported costs and returns to a sample of farms.

Comparative analysis then may occur on two interrelated levels. On the organization level, studies focus on patterns of relationship between structural, processual, and contextual variables. Contextual variables refer to

the set of factors or conditions that exist outside the organization yet directly or indirectly affect its growth and development.

On the population level, studies focus on contextual conditions and their consequences for growth and decline of organizations. The Agricultural Census is the most readily available source of these data (Wimberly and Belyea, 1978). Comparative analyses of sets of populations investigate the impact of contextual conditions on the distribution of organizations and organizational characteristics in a population. Less attention is given to specific organizations but rather to shifts in the number and kind of organizations over time.

At the most comprehensive level, the population ecology approach to organizational analysis reflects a shift in theory and research to the effect of environment on organizational structure. Hannan and Freeman (1977) argue explicitly for a population approach to organizations, examining aggregates of organizations, the elements having some unit character or being alike in some respect. Farms are one such class of organization that is relatively homogeneous, particularly within commodity groups. Populations of farm organizations might be defined as all units within a particular geopolitical system. Population ecologists focus on the distribution and number of units in a system, identifying the circumstances or limiting factors affecting the conditions of their existence.

Following the Hannan and Freeman approach, research at the communities of organizations level examines variability in environmental conditions that affect the growth and development of populations of organizations. Important questions flow from the notion that social organizations in equilibrium exhibit structural features that are specialized to salient features of the resource environment. For example, what ecological conditions contributed

to longitudinal shifts in the number, size, and functional specialization of farms within U.S. counties vetween 1968 and 1974? Differential levels of change might be linked to various ecological properties of the counties.

Frisbie and Posten (1975; 1976; 1978) have employed ecological measures of the concentration or dispersal of individuals across occupation categories, linking sustenance differentiation to population migration and change. Studies of populations of farm organizations may focus on sustenance differentiation, as well as farm unit population properties, both in their longitudinal and cross-sectional components. Population characteristics then become dependent variables to be explained by characteristics of the organizational environment. A fundamental question is: what forms of sustenance organization develop and which forms disappear under varying environmental circumstances.

Zald (1978) takes a somewhat different approach to the study of populations of organizations. His concerns lie less in the analysis of growth and decline processes, and more on the social control of industries. An industry is a set of firms producing a product or closely related group of products (Zald, 1978:81). A member of an industry is evaluated and sanctioned as it is compared to other similarly situated organizations. Zald is interested in understanding differential responses to societal norms as reflected in government regulation, as well as the effect of industry structure and composition on the regulatory process. He introduces a useful set of dependent variables based on the readiness and capability of sets of organizations to comply with changing social norms and regulatory environments. A key dependent variable or object of analysis is the range of industry performance on some normatively defined item. A performance curve is the range and distribution of performance on some standard of compliance, analogous to a diffusion curve for innovations.

An industries approach first identifies the regulatory bodies affecting an industry and the relations between the industry and the control agents. Questions of interest about farm organizations relate to the extent of compliance with various government regulations. Explaining differential response to environmental regulations on chemical use and management is a central example. A general summary proposition states: the greater the normative clarity, the greater the surveillance, the stronger the sanction, the more unified the structural context, the greater the compliance readiness and capacity, the narrower the range of performance (Zald, 1978:99). Thus farmers' response to a direct pesticide ban is likely to be greatest in a county where an EPA office is located, where a large fine would be imposed, where many similar farm operations exist, when the banned substance is readily substituted, and when the farmers are familiar with procedures for handling the substitute. Zald seems to be suggesting that sociologists study the adoption and diffusion of regulation in society, much as previous research focused on innovation.

The previous discussion has examined population and organizational levels of comparative analysis. The industries approach is a variant of population analysis that focuses on normative control structures and their effect on populations. Both levels of population analysis are accessible through successive aggregation of comparative analyses on the organizational level. Population approaches are particularly useful for analyzing Agricultural Census data available only in aggregate form. The remainder of the paper is directed to comparative analysis on the farm unit level with particular attention paid to structural changes in individual firms as related to technological, contextual, and managerial factors.

Organizational Properties of Farm Firms

Ownership Structure. The internal ownership structure of the farm unit is a central feature of organizational structure. The corporation is one of a number of possible business organizations in farming--sole proprietorship, partnership, trust, and cooperative being others. Two basic types of corporate farms are the private closely-held corporation and the publicly traded non-closely held investor corporation. The latter is the most distant from the traditional family farm and often involves large conglomerates engaged in nonfarm activities (Goss and Rodefield, 1979:6). Many family farms incorporate for tax purpose, thus a corporate-family distinction is not clear-cut.

Beyond legal-economic distinctions, few attempts have been made to apply sociological conceptions of organization to the farm. Price (1972) compiled a measurement handbook of 23 central concepts of organizational research. Certain structural characteristics of farm organizations are directly comparable to the organizational properties he described and are particularly relevant in the study of agricultural production units.

Complexity. Complexity is the degree of structural differentiation within a complex organization (Price, 1972:76). Vertical complexity refers to the number of authority levels in an organization whereas the number of occupational roles and the number of sub-units illustrate horizontal complexity.

Farms have been traditionally characterized by a low division of labor, as farm work was largely cyclic and all available human resources were generally required for the task at hand. However, some differentiation or segmentation of occupational roles may be observed in larger operations that require specialized attention to specific tasks or roles that require fulfillment on a continuous or routinized basis. Examples might be an equipment

repairman or feedlot manager. The variable nature of farm work suggests, however, that when functional differentiation takes place, it is likely to occur in a diffused manner subject to situational needs or exigencies.

One measure of functional complexity is the number of crops grown or commodity types produced, also termed enterprise structure. Farm diversification is an important structural feature that may have important consequences for farm unit behavior and efficiency.

Effectiveness. Effectiveness is the degree to which a social system achieves its goals (Price, 1972:101). Performance or organizational success has been approached from a number of different vantage points. Profit is a general outcome measure for economic organizations, and probably the most general farm organization criterion. Within commodity groups, measures of yields or gain are technical measures of efficiency that are closely related to the concept of effectiveness. When a social system has multiple and diverse goals, effectiveness may be usefully conceived in terms of an aggregate or composite balance of various individual efficiencies.

Efficiency. Efficiency is a complex construct that generally refers to the achievement of a goal with a minimum of waste or unnecessary efforts. Monetary efficiency or profit-making is a primary component of most definitions of effectiveness, but other factors are likely to enter into any overall evaluation of farm unit effectiveness.

A problematic aspect of evaluating farm units on a comparative basis is the variety of dimensions on which efficiency may be based. Environmental efficiency may bring lower yields (profits) but may include soil and wildlife conservation, and the minimization of chemical expenditure as criteria. The debate over the problems of small farms centers about the notion of social efficiency, which often is at odds with measures of effectiveness or economic

efficiency. Much of the controversy involves differences over the standard of efficiency, the time frame applied, and the level on which the efficiency is to be evaluated. What is good for agriculture, what is good for the consumer, and what is efficient for the individual farmer often are opposed to one another.

Saint and Coward (1977) note the increasing emphasis given to distributional impacts in the evaluation of technological efficiency. Comparative studies of farm organizations might fruitfully approach efficiency on a multidimensional basis to assess relationships among dimensions and to determine factors contributing to individual types of efficiency. Important empirical questions relate to the nature and kind of efficiencies farm operators attempt to maximize or tradeoffs in different kinds of farm decisions. What efficiencies contribute to an overall notion of effectiveness?

Size. Size is the scale of operations of a social system (Price, 1972:174). Most research on organizations approaches size in terms of the number of personnel, the amount of assets, and the level of expenditures. Melman (1956) identified several measures of size: number of organizational production personnel, total assets, average number of wage earners per establishment, average value added by manufacture, and net sales. Most farm-oriented research focuses on sales as a measure of size, although acreage may be an additional comparative dimension within commodity groups. Differential levels of mechanization may limit the reliability of size indicators based solely on the number of personnel.

Size is an important variable because of its implications for a units ability to relate to the organizational environment. Larger units generally are more able to withstand uncertain environments, and to possess greater absolute levels of slack resources for innovation or adaption. Size, as it

is commonly conceived, contains components of intensity as well as extensiveness (or scale).

Some researchers studying size in agriculture distinguish scale from intensity as important sub-dimensions. A cattle ranch may be greater in physical expanse than a vegetable operation. The greater investment of resources and labor in the vegetable operation may make it equal or larger than the cattle operation on many labor or fiscal measures of size. Many such considerations confound comparative evaluations of the size dimension. Even with commodity types, differential rainfall or soil productivity may further diminish the intercorrelations among various measures of farm size.

Mechanization. Mechanization is another important variable. One study used horsepower per wage earner as a measure of mechanization (Melman, 1956). Others have examined workflow integration or the extent of automation as an organizational variable (Inkson et al., 1970). On a population level, mechanization often tends to accelerate the rate at which large units grow and small units decline.

Other Organizational Variables. Many other organizational variables are relevant for the study of farm operations. A broad literature is devoted to the study of innovation in farm organizations (Rogers and Shoemaker, 1973). The autonomy of farm units vis à vis certain aspects of the organizational environment (markets, suppliers, services) deserves further scrutiny (Dill, 1958).

Certainly many individual-level variables such as motivation, satisfaction, or communication are relevant to the study of farm organizations. Comparative analyses of farm organizations should examine managerial styles and other social-psychological characteristics as having important consequences for organizational processes.

Sociological Approaches to Organization

The sociological literature does not take a unified approach to the analysis of complex organizations. Instead, several competing streams of thought or perspectives exist, each developed in response to characteristic problems of contexts that shape a view of organization. Three major approaches are reviewed and evaluated for their contribution to explaining and understanding farm unit behavior: exchange theory, systems theory, and the technology perspective.

Exchange. The exchange approach to organizations focuses on reciprocity and the pattern of interaction among organizational members. Analysis of intra-firm patterns of interaction may be useful for understanding the social structure of a farm unit and its workflow characteristics. Comparative studies could link shifting systems of interaction to different structural conditions and enterprise mixes.

An important concern in exchange approaches to organization is the analysis of resource flows and dependency relations on the organizational environment. Breimyer (1977:17) notes a shift to more resources of nonfarm origin. According to some estimates, the fuel, machinery, chemicals, veterinary services, and other inputs obtained from outside farming amount to almost two-thirds of resources used. Land and the farmer's labor are now barely more than one-third. Patterns of dependence are often patterns of control having significant effects on decision making when alternate sources of inputs or receivers of output are not available (Dill, 1958; Emerson, 1958). The adaptation approach to organizational analysis emphasizes organization-environment transactions as a central determinant of success and survival. Macro-level exchange theory provides a framework for understanding some of the consequences of resource flows and dependency patterns.

Open Systems. Open systems theory also emphasizes the close relationship between a structure and its supporting environment (Katz and Kahn, 1973:3). Special attention is given to organization-environment interaction and its role in maintaining the organization. Farms are adaptive structures within a changing environment that must be coped with if equilibrium is to be maintained (Haas and Drabek, 1973:99). Katz and Kahn argue that the most important maintenance source is human effort and motivation. Thus, social-psychological factors inform open systems analysis of the production process. Individuals are the carriers of the system, providing the sustaining inputs for the input, throughout, and output process.

Open systems theory stresses transactions with the organizational environment, characterized by efforts to cope with uncertainty and changing operating conditions. Most transactions with the environment are monitored through the managerial system, so the external relationships of an organization's officers comprise a critical set of variables for predicting the effectiveness and survival of the organization itself. Thus, the open systems approach would focus on a farm's transactions with the organizational environment, the ability to exploit resources in the environment being a key indicator of effectiveness (Yuchtman and Seashore, 1967). As greater proportions of non-farm resources are applied to production (Breimyer, 1977), the operator's ability to coordinate and efficiently employ the services of custom applicators, repairmen, and technical consultants has an increasingly greater bearing on success.

The open systems approach also is distinctive from many others in its emphasis on managerial factors in the growth and development of the organization. Many of the managerial dimensions explored in other contexts could be fruitfully applied to farm managers and linked to organizational outcome

variables. Certain contingencies or constraining interactions may exist between managerial style and farm workflow characteristics.

Technology. The technological perspective provides a useful framework for explaining the structure of agricultural production units. Technology is viewed as having a critical impact on social organization. Lenski (1970:103) treats technology as a set of prior conditions that limits the range of possible solutions to organizational and ideological problems. He argues that agriculture should be approached from a multilineal evolutionary point of view; that is, change is occurring on many fronts at the same time, but that a limiting factor in the course of that change is the set of technological strategies that can be employed.[3]

Technology exists both within and outside the organization. Katz and Kahn (1978:136) differentiate two technologies, the internal technology of a firm and the external technology potentially available to it in the larger environment. They employ the term technological environment to refer to knowledge about technical processes and machine design existing outside the organization itself. Flinn (1970) has shown how community values and the informational milieu influence the technological innovativeness of farm organizations. The state of technology in an industry is an environmental influence on a specific organization as internal technology is an influence on social structure. The technology that is part of the organization should be differentiated, however, from the technology of the larger milieu (Katz and Kahn, 1968:137).

Studies focusing on technology in organizations often consider the transformation process or method of assembling output as a major variable. Several studies have demonstrated the effects of process technology on the social-psychological orientations of workers (Blauner, 1964; Fullan, 1970). Price

(1963:39) links continuous systems of output assembly to greater levels of effectiveness than batch systems of production. Woodward (1965) found systematic variations in organization structure to be linked to variation in manufacturing technique. Different technologies create different kinds of demands on individuals and organizations, and these demands tend to be met through an appropriate structure (Haas and Drabek, 1973:75). On farms, technology tends to make its most direct impacts on the displacement of seasonal labor.

In production organizations, the input-conversion-output cycle represents a single basic technological sequence or organizational substrate (Hunt, 1970:240). The key factor may not be the particular properties of inputs or outputs per se, but the technologies by which they are accomplished. The relationship of organizational structure to organizational process is the central focus of technological explanations. Technology sets limits for a viable range of organizational properties. The limits may not be directly observable in a fixed contingency relationship between process technology and structure, but may have a selectivity effect in the long term growth and survival of segments of a population of organizations. On farms, one of the primary effects of technology is the displacement of farm labor through mechanization. Technology also affects organizational populations by increasing capitalization requirements, shifting the central tendency of size upward.

In his review of technology measures, Scott (1957:7) notes that the concept is not a simple one and that several underlying dimensions, such as variability and complexity, seem to be involved. A problem with most measures of technology is that technologies vary greatly within as well as between organizations. In addition, some measures focus on the role of the worker while others characterize the larger work process. Some jobs may become more

simple and routine as the system-level work process gains in complexity (Scott, 1975:7)

In agricultural production, the dimension of primary interest is likely the system-level intensity of technology application. Differences in the certainty, complexity, and predictability of technology may explain significant variation in structure across commodity groups.

Perrow (1967:194) distinguishes two dimensions of raw material that affect technological selection: (1) the degree to which characteristics of the raw material are perceived to be understood; and (2) the degree to which the raw material is perceived to be stable so that it can be treated in a standardized fashion. Agricultural raw material consists of weather, soil, and crop or animal characteristics. Understanding is probably greatest for the latter factors, but weather control research is proceeding at a rapid pace. The stability of the raw material is an important variable, but one not easily generalized. Factors such as disease resistance, ability to withstand drought, availability of irrigation, etc. all contribute to raw material stability. Most efforts at improving varieties or breeds are really aimed at improving the stability or standardized nature of the commodity.

Saint and Coward (1977:734) note the increasing tendency to view technology as a variable instead of as a given, and to see social organization as an independent variable as well as a dependent one. Agricultural technology may have differential effects on different segments of production systems, and alternative technological arrangements may exist for achieving any given task.

New technology often changes the nature of human involvement in the production process. Miller (1957:327) notes the dramatic changes in agricultural organization associated with introduction of the John Deere plow, the

McCormick reaper, the Appleby twine binders, and the cotton gin. Each of these inventions altered the relationship of human labor to the production process and introduced shifts in the optimal scale of farm operations. These changes are continuing to this day (Rodefeld, 1978). A current example is the displacement of seasonal labor in California's central valley by mechanical tomato harvesters. Addition of optical sorting devices further reduces labor requirements to one-fourth previous levels. Seasonal agricultural labor is being replaced by full-time agricultural employees with different types of commitments and relationships with the farm owner (Goldschmidt, 1978).

Several factors underlie shifts in agricultural technology. Efforts to reduce environmental uncertainty is one motivating force (Emery and Trist, 1965). Organizations seek to secure and maintain an orderly and reliable flow of resources. When labor began to organize in California, and the threat of crop loss due to strikes became a real concern, producers strove to reduce dependence on large blocks of organized labor and shifted toward smaller pools of better-compensated permanent employees in highly mechanized operations. Increasing costs and regulation of farm labor have been an additional factor (Fuller and Mason, 1977). Hightower (1971) has detailed some of the consequences of the shift toward new technology and its consequences for consumers and rural people. He gives critical attention to the role of the experiment station system in promoting technological change.

Decreasing labor inputs and increasing mechanical approaches to farm production required increased uniformity in the production process. Level areas were generally first to have new methods implemented, and in many cases the face of the land was altered to adapt to available technology. California's San Joachim delta is a notable example. More intensively than in other locales, crops were genetically altered and selected to offer uniform plant

heights, ripening times, and surface consistencies to survive machine handling. Standardized production material paved the way for further improvements in machinery technology.

Mechanization and the Falling Rate of Profit

Mechanization has progressed most rapidly in the 20th century, as has shifts in the scale and organization of agricultural production. The primary source of changes in organization and structure is technology and the increasing scale and capitalization required to obtain the benefits of innovations in production techniques. Figure 1 diagrams hypothetical relationships between size and efficiency under two levels of technology. New technology requires larger yields, greater acreages, and more intensive farming to recoup large initial investments. Farms below a certain size are less efficient with the technology, while beyond a certain point firms receive increasing gains.[4] Farms must either expand to the size where technology can benefit them or remain at a continuing competitive disadvantage to large operations that can benefit from the improvement. Further advances are likely to shift optimal size further toward the large-scale operations and have other effects on industry structure.

The pressure toward mechanization and increase in scale has been identified as a generic trait of capitalist production systems. Marx (1867:265; 1849:186) believed that in the long run the key to lowered production costs lay in mechanization. Thus, economic competition motivates individual capitalists (farmers) to substitute increasingly efficient machines for human labor (Applebaum, 1978:75). The human impact of mechanization has been a common focus for many critics of large scale agriculture (Rodefeld et al., 1978).

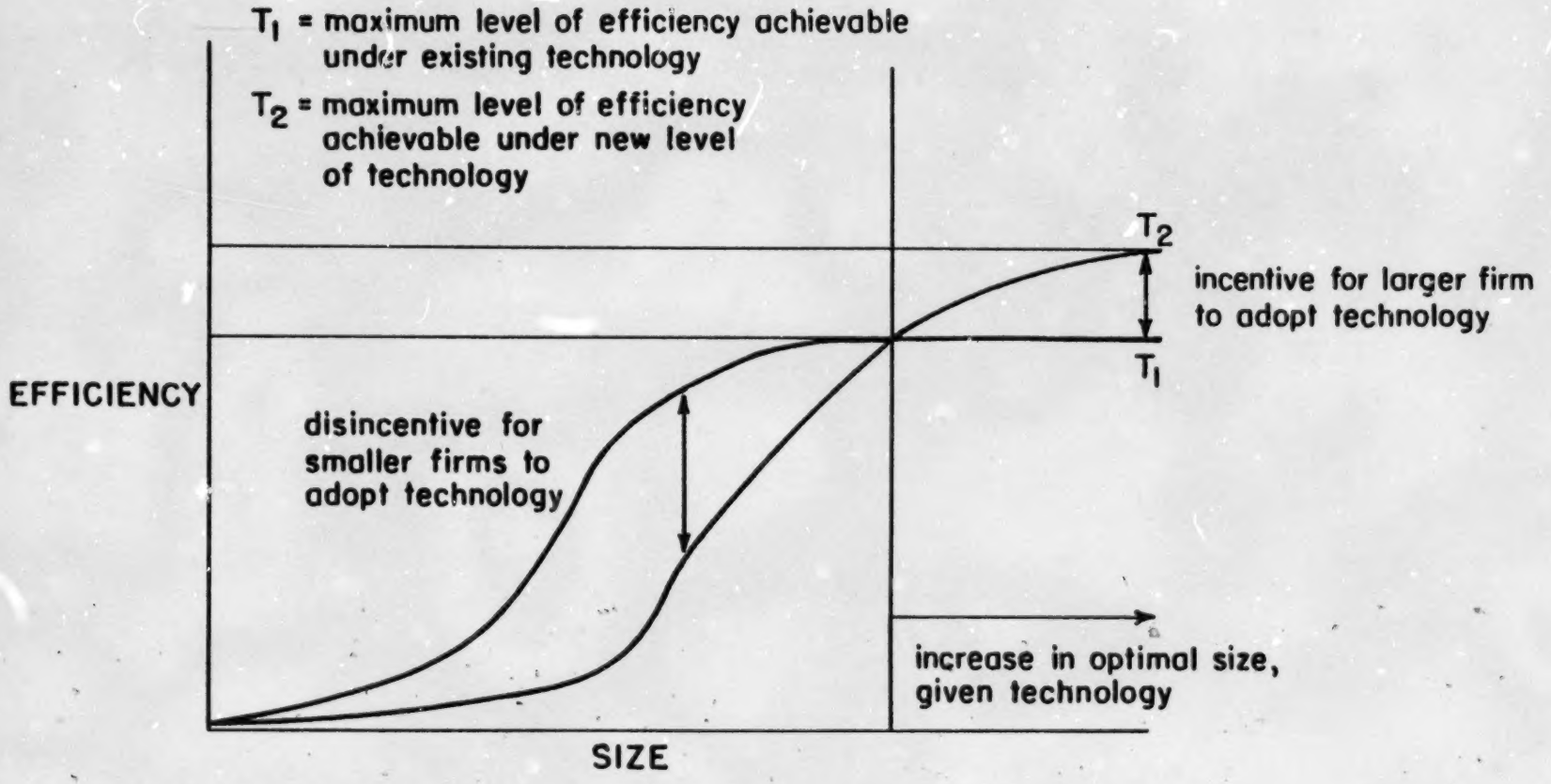

T_1 = maximum level of efficiency achievable under existing technology
T_2 = maximum level of efficiency achievable under new level of technology
T_2
T_1
incentive for larger firm to adopt technology
EFFICIENCY
disincentive for smaller firms to adopt technology
increase in optimal size, given technology
SIZE

Figure 1. Size-efficiency relationships for two levels of technology.

The tendency for fewer workers to produce ever-larger quantities of goods with ever-decreasing amounts of labor affects the rate of profit in an industry. Based on the Marxian premise that surplus value or the excess or unpaid value of worker contributions to the production process is the key to capitalist economic production as the source of all profits (Applebaum, 1978:79), mechanization decreases the amount (and relative proportion) of labor available for exploitation. Thus, increases in profit must be derived from multiplying the productivity of a diminishing labor input by expanding capital inputs, expanding the base for computing profit and thereby reducing the rate of profit.

The saying that "It takes money to make money" takes on real meaning when capital inputs are seen as mechanisms for leveraging labor inputs into profits. The tendency for a declining rate of profit in an industry is very suggestive for explaining shifts in the structure and scale of agriculture and understanding the pressures on individual farmers (capitalists) to adopt certain management and growth strategies.

The individual farm organization is forced to economize and increase the output per worker through substitution of labor-saving technologies. Units that cannot participate, or do not participate, effectively in the capital expansion process either are absorbed into other units or seek labor returns from non-farm sources (part-time farming). Economic crises tend to accelerate transitions for those most vulnerable to such shifts.

The Marxian elements of capital, labor, and surplus value provide analytic categories for understanding structural relationships and tendencies in a population of organizations (Applebaum, 1978:77). They provide deeper understanding of changes in the structure of agriculture beyond simple allusion to "shifting economies of scale."

A focus on structural determinants of population characteristics implies that technological and managerial variables are intervening factors affecting the growth and decline of individual farm organizations. Structural feature of various commodity industries represent broad-based determinants of the responses of individual units to changes, opportunities, and shifts in operating conditions.

Technology and Commodity Type

The previous discussion has approached technology as a general phenomenon displacing human labor by mechanical knowledge. Such changes were linked to shifts in the size and scale of agricultural organization.

A second line of discussion about technology in agriculture is directed to the type of commodity as representing a technological type associated with a characteristic form of organization. Certainly the organization of time, personnel, and effort is different on a dairy farm than on a wheat farm, or on a vegetable truck farm. The patterning, work cycle, and process associated with each operation gives rise to different internal structures as well as different macro-level patterns of organization.

Different commodity-technologies also have consequences for off-farm relationships and dependencies. The fragility or perishability of the commodity has an important effect on the autonomy of the organization in terms of its ability to store the product for better market or transportation conditions. Commodities with short consumption and processing cycles may face an additional set of constraints in responding to production technology, but may be particularly affected by new developments in storage or processing. The Harvestore silo increases the ability of a grain farmer to select marketing conditions by buffering or leveling his dependence on storage facilities (Thompson, 1967). When adopted on a collective basis, however, extensive

stocks of privately stored grain may have an overall depressive effect on prices when slight increases in price engender large increases in supply.

Research employing technology to explain the behavior and organization of farm firms faces difficult problems operationally defining type and level of technology. Previous studies have examined technical specificity, i.e. when there are fewer product changes (Harvey, 1968:247), uniformity of product (Perrow, 1964), as well as certainty of production process. Researchers may profitably focus on levels of technological development within specific commodity types, developing guttman scales of technological intensity that might be related to various measures of size, scale, efficiency, or productivity.

Conclusion

This paper has selectively reviewed concepts and perspectives on complex organizations with a view toward their application to agricultural production units. The review was intended to be largely suggestive and by no means exhaustive. Many of the concepts discussed here can be usefully measured and empirical relationships determined.

On a very general level, four lines of comparative inquiry are suggested by this review: (1) population characteristics, (2) organizational unit characteristics, (3) farm manager characteristics, and (4) environmental characteristics.

Population studies of the farm industry seek to link ecological characteristics to changes in the number and distribution of farm firms. While so-called adaptive approaches emphasize the ability of organizations to scan the environment, a number of factors contribute to inertia in organizational response to changing conditions. Instead, changing environments exert a selection effect on certain segments or classes of organizations. This approach

attempts to show how characteristic farm types were selected by conditions in the social, economic, technological, and regulatory environment (See Figure 2).

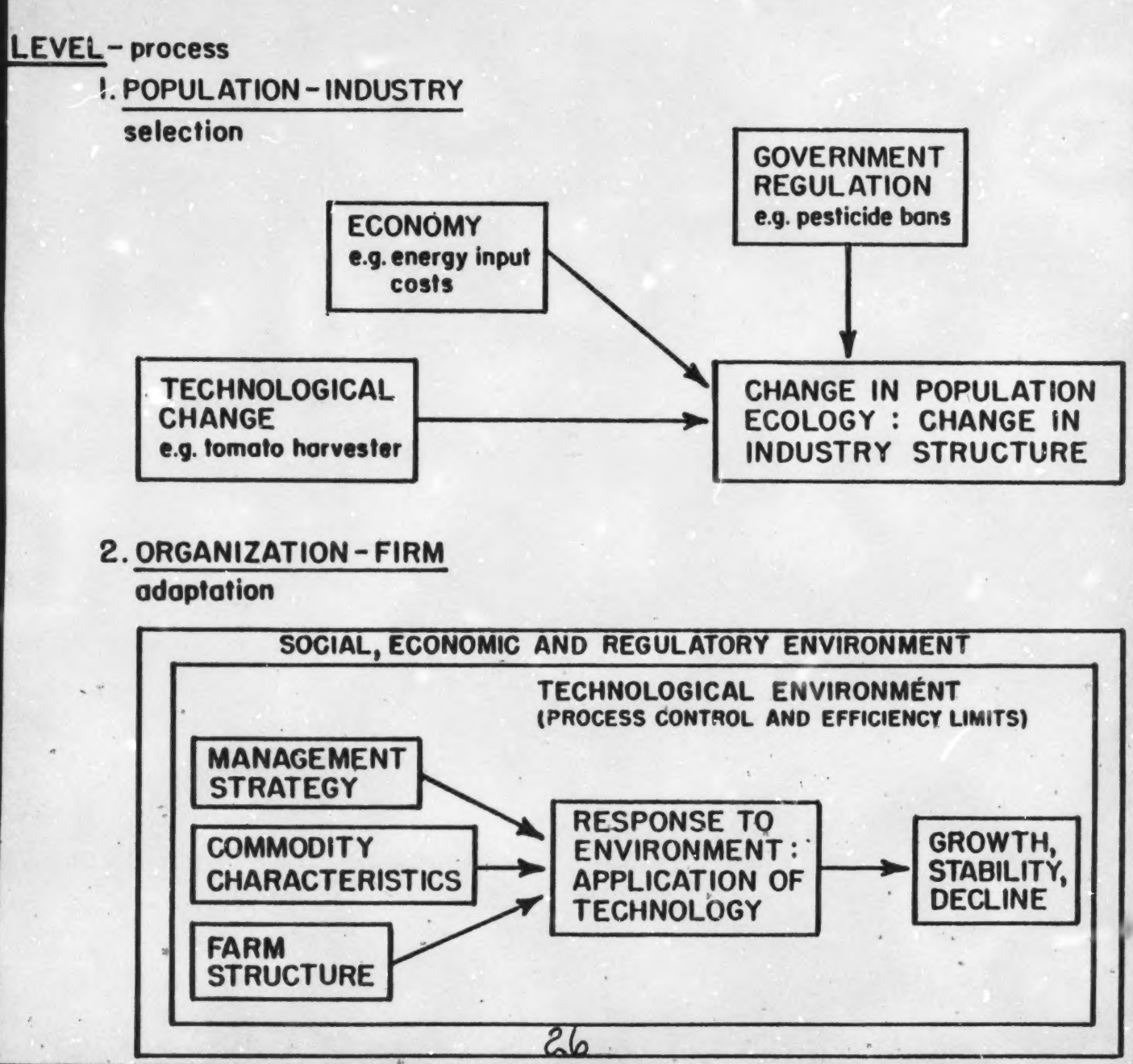
Comparative studies of farm organizations must examine the size, scale, and internal structure of farm organizations in order to determine their behavioral characteristics, and responses to environmental conditions. These processes are most precisely determined within commodity types, but it is also important to discover those processes operating across commodity divisions.

In addition to assessing relationships among measures of internal structure, attention should be paid to outcome measures of effectiveness and efficiency. Multiple measures of efficiency exist and should be assessed, particularly as they relate to some overall, subjective measure of effectiveness. The order of importance of different kinds of efficiencies is a value-political question that can be assessed as an attitudinal dimension, but should not be viewed as an invariant structural parameter.

Managerial characteristics represent a second set of conditions suggested by open systems theory. The openness to innovation, educational levels, and motivations of farm operators are fundamental forces determining organizational responses to environmental conditions and technological change. Such factors may determine the character of individual decisions as well as overall farm management strategies.

The external technology of the organizational environment represents a central set of factors determining the range of solutions available for organizational and productivity problems. Technology can be employed to reduce uncertainty by supplanting less predictable human elements with repetitive machine processes. Technology mediates the human input-productivity process. Technology can leverage existing organizational members to increase output

Figure 2. Population-Industry and Organization-Firm level models of selection and adaptation in response to technological change.



or can be used to eliminate participants while maintaining output. Technological change and variability in intensity of application represent key variables affecting the structure of agriculture organizations as well as the population structure of those units (Hannan and Freeman, 1977).

Comparative research on farm organizations will selectively employ managerial dimensions, farm organization variables, commodity characteristics, and environmental factors to understand patterns of efficiency and effectiveness in farm organizations and to better define those factors contributing to growth and decline in the population of farm production units.

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